Letters to the Editor (Reply: See p. 240)

Life Cycle Assessment Study on Resilient Floor Coverings
by Albrecht Günther and Horst-Christian Langowski, Int. J. LCA 2 (2) 73-80 (1997)

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GÜNTHER and LANGOWSKI (1997) compare different materials used for resilient floor coverings by means of Life Cycle Assessment.

1. In this study commissioned by the individual member companies of ERFMI (European Resilient Flooring Manufacturers Institute), the authors neglect to draw any conclusion from the environmental preferences of the materials they compare.
2. It is also of interest to compare their results to the results of the LCA studies by POTTING and BLOK (1995) and JÖNSSON et al. (1997).

The interest in the environmental performance of floor coverings is largely sparked by the heated debate on PVC in recent years. Therefore, this letter focusses on the comparison between PVC, polyolefins and linoleum floorings; the latter two are interesting PVC alternatives.

GÜNTHER and LANGOWSKI present results for some **impact categories** (→ *Table 1*). This list does not cover all relevant impact categories compared, e.g. to the default list suggested by UDO DE HAES (1996). Thus, it is not possible to draw conclusions concerning the total environmental performance; conclusions must be restricted to the impacts considered. In **Table 1**, the results for the alternative materials are compared to the results for PVC which is the reference product (this interpretation method has been suggested by LINDFORS et al., 1995). Because of the data variation stated (GÜNTHER and LANGOWSKI (1997), only tentative conclusions are drawn in this comment.

1. With regard to the comparison between **polyolefins and PVC**, the study by GÜNTHER and LANGOWSKI (1997) reveals the following results (→ *Table 1*):

   The gross energy demand seems to be lower for polyolefins, which is also the case when only non-renewable energy resources are considered. There is little difference in the water demand and the production of municipal solid waste. The demand for the production of chemical waste, however, is lower for polyolefins which also seem to score better with respect to both acidification and global warming potential. Thus, it seems that polyolefins are the better alternative for the impact categories considered.

2. With regard to the comparison between **linoleum and PVC**, essentially the same results as for polyolefins are obtained by GÜNTHER and LANGOWSKI, with the exception of the global warming potential (→ *Table 1*). Some of these results can be compared to the results of previous studies by POTTING and BLOK (1995) and JÖNSSON et al. (1997) presenting similar results for the use of non-renewable energy resources and acidification potential. The difference for the global warming potential is probably due to different assumptions concerning the management of solid waste, since a major source of "greenhouse gases" in the linoleum life cycle modelled by GÜNTHER and LANGOWSKI is emissions from CH_4 from landfills where the flooring end up after use. The results for global warming potentials are probably rather sensitively to the different assumptions concerning waste management practises (how much is landfilled and incinerated, what are the emissions from landfilling and incineration, etc.). The latter are questions which need further research (FINNVEDEN and HUPPES, 1995).

Ad 1: Although, in general, the PVC discussion has centred around toxicological and ecotoxicological impacts, the study by GÜNTHER and LANGOWSKI does not consider these impact categories. Based on a qualitative discussion, however, some preliminary conclusions can be drawn with regard to toxicological and ecotoxicological impacts, when polyolefins and PVC are compared:

1. Both are based on petrochemical resources, and monomers of polyolefins can be used as starting materials for PVC production. Most of the potential impacts caused by the production of polyolefins will therefore be present also in the life cycle of PVC.
2. In addition, PVC can cause impacts when chlorine is produced (e.g. by the releases of mercury), when PVC itself is produced (e.g. by the emissions of chloro-organic compounds), in the treatment of PVC waste, and in the presence of stabilisers (e.g. lead) and plasticisers (e.g. phathales).

Therefore, it seems to be reasonable to assume that polyolefins may score better than PVC with respect to the toxicological and ecotoxicological impact categories.

Ad 2: The comparison between PVC and linoleum is somewhat more complicated with respect to (eco-)toxicological impacts, since the use of pesticides in the life cycle of linoleum is difficult to compare to the potential problems in the life cycle of PVC (FINNVEDEN et al., 1996).

Based on the above mentioned discussion, some tentative conclusions can be drawn.

1. With respect to the impact categories considered (i.e. the categories considered by GÜNTHER and LANGOWSKI, see *Table 1*, plus the toxicological and ecotoxicological categories), polyolefins seem to be a better option than PVC.
2. With respect to the comparison between linoleum and PVC, there are uncertainties concerning the global warming and (eco-)toxicological impact categories.
3. For the other categories considered, however, linoleum seems to be a better option.

Also JÖNSSON et al. (1997) and POTTING and BLOK (1995) conclude that linoleum is environmentally preferable to PVC flooring. In environmental policy, the following substitution principle is often advocated: if there is a choice between two functionally similar products, the more environmentally friendly should be chosen. The results discussed in this comment, together with the substitution principle, can be used to argue that PVC floorings should be avoided.

The **usefulness of LCA** is sometimes questioned. The discussion above can be used to illustrate LCA as a tool. Although it is not possible to draw definite conclusions from the total environmental impacts associated with different materials (partly, because not all relevant impact categories are included), it is, nevertheless, possible to draw some conclusions which can be helpful to policy-makers and decision-makers at different levels, e.g. involved in purchasing.

LCAs can also be useful in identifying key issues, e.g. important areas for improvements. In this example, changed formulas of floorings, increased use of recycled material and recovery and reuse of waste floorings are possibilities for improvements (GÜNTHER and LANGOWSKI, 1997). LCAs are sometimes accused that they are not reproducible. Therefore, it is interesting to note that there are three studies comparing PVC and linoleum floorings which are possible to compare for some impact categories (→ *Table 1*). The results are reproducible in the sense that they either produce similar results, or the differences can be explained by differences in the system boundaries used.

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Table 1: Alternative materials for floor coverings compared to PVC.
+: the alternative material is probably better than PVC
−: the alternative material is probably worse than PVC
0: there is probably no difference between the alternative material and PVC

Alternative material	Polyolefins	Linoleum	Linoleum	Linoleum
Reference	GÜNTHER and LANGOWSKI (1997)	GÜNTHER and LANGOWSKI (1997)	POTTING and BLOK (1995)	JÖNSSON et al. (1997)
Gross energy demand	+	+		
Non-renewable energy resources	+	+	+	+
Water demand	0	0		
Municipal waste	0	+		
Chemical waste	+	+		
Acidification potential	+	+	+	+
Global warming potential	+	−	+	+